Beam Test Status Report

GLAST Collaboration Meeting

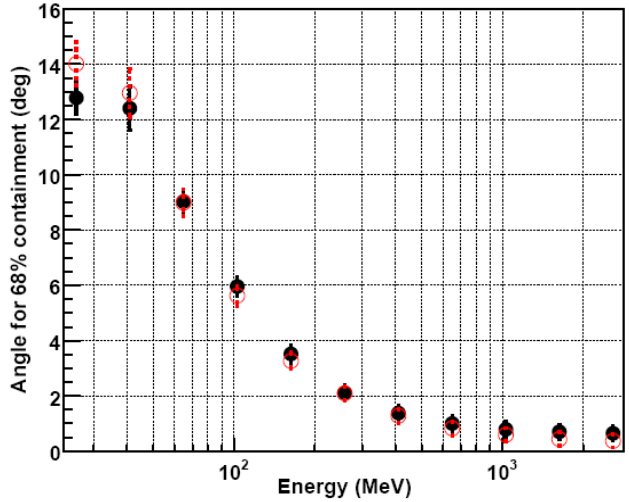
SLAC July 2007

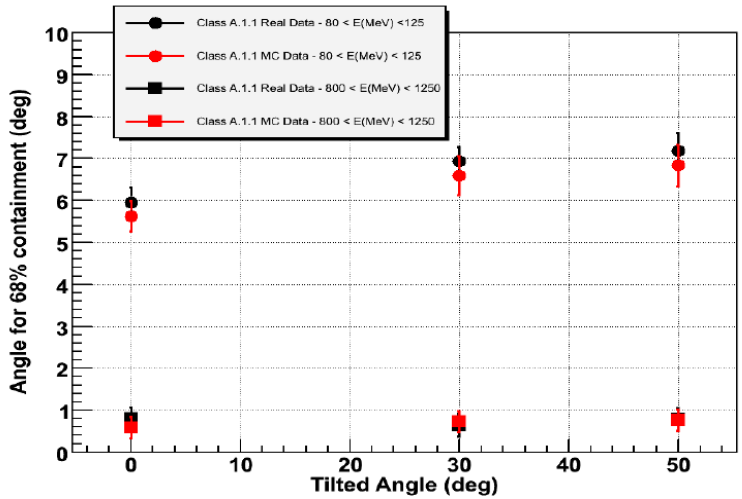
Outline

- Update on TKR angular resolution and hit count
- Udpate on CAL energy measurement
- Simulation validation
- Update on ACD backsplash
- Status of deliverables
- Plans forward

TKR Performance – Angular Resolution

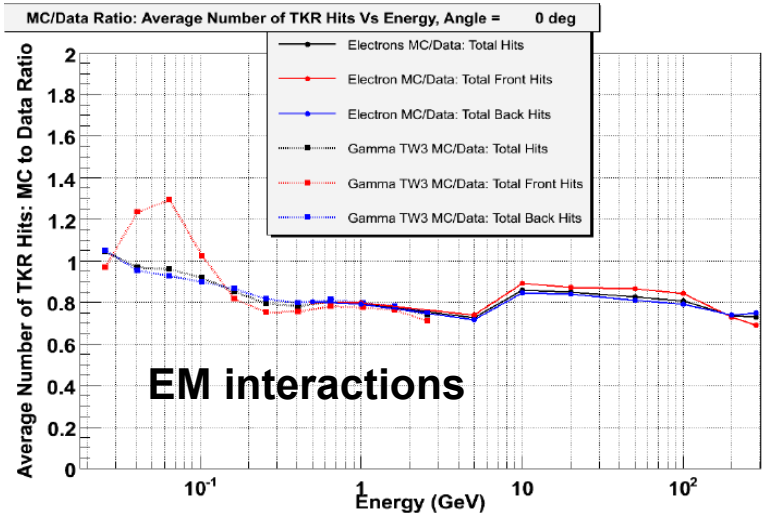
- 68% angular dispersion for vertex events
- Good Data/MC agreement
- Comparable results from tagged photon runs
- *Mention PSF with e- and issues with tagged photons?*

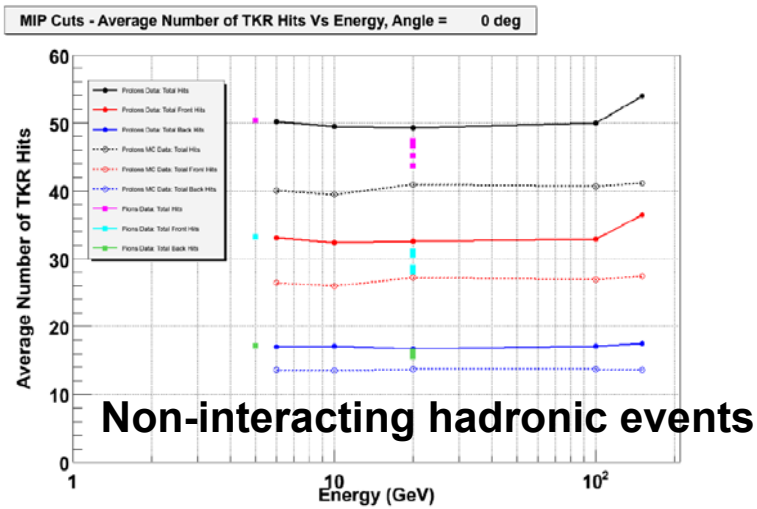




TKR Signal - Hits

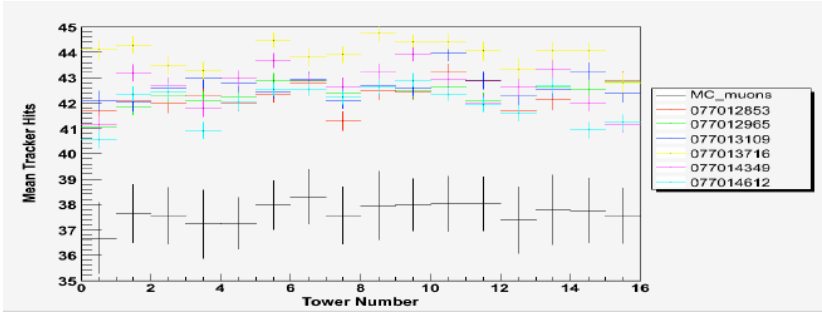
- MC simulations show fewer hits than data
  - ≈20% less hits
  - ≈10% less clusters
- Independent of beam line, trigger type, incoming angle, energy, particle (γ, e, hadrons and CR muons)
  - not a data excess (e.g. noise or beam halo)
- Does not affect PSF
  - negligible difference on best 2 tracks
  - Significant artificial noise increase does not impact tracking and direction reconstruction

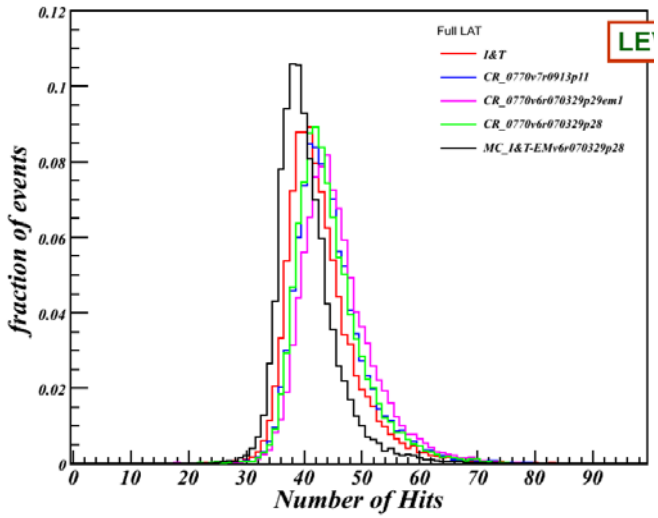




TKR Hits with CR LAT data

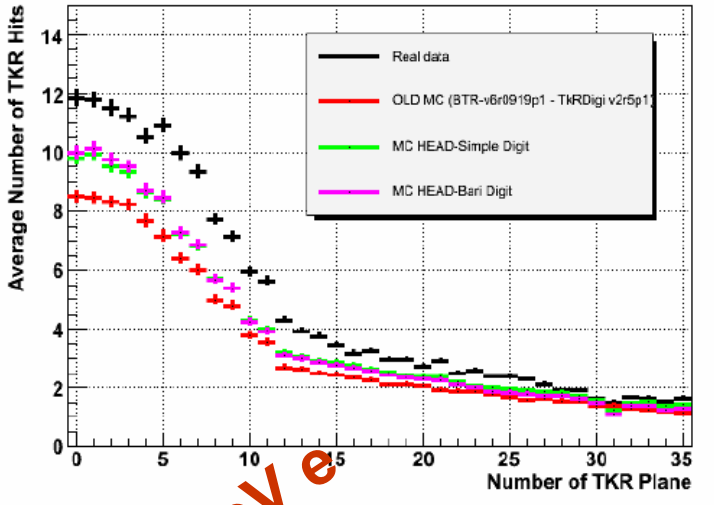
- **Similar situation with CR μ**
  - **Confirmed by independent analysis on observatory and I&T data**
  - **Variable with tower**
  - **Still true with stringent cuts selecting straight through particles**
  - **≈10% less hits in MC**

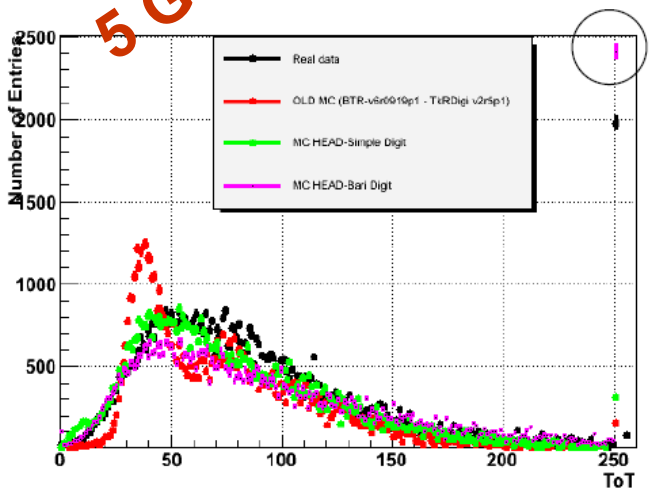




TKR simulation products

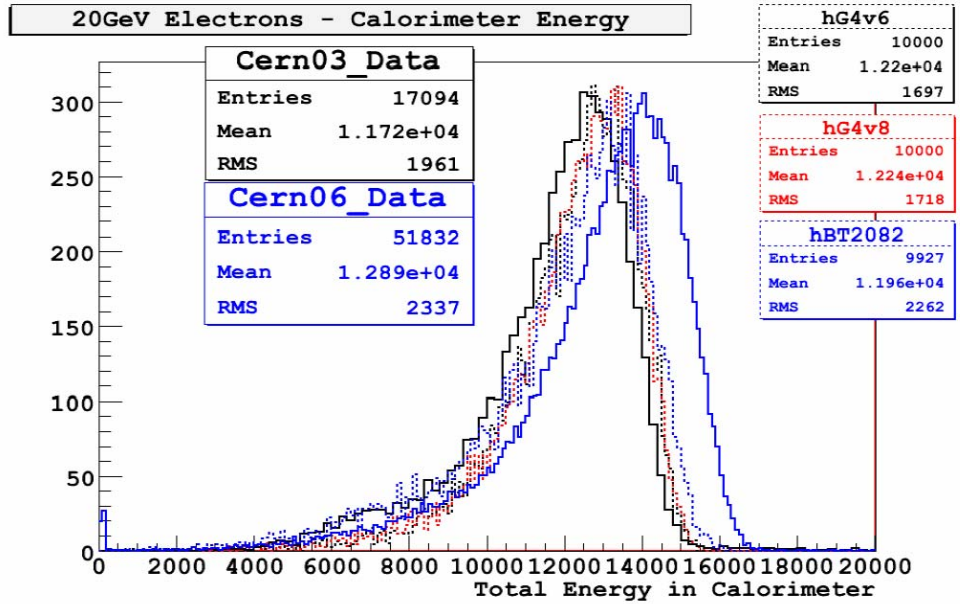
- 2 updated TKR digi algorithms
  - SimpleAlg:
    - strip xtalk for ion signals
  - BariAlg:
    - charge sharing through charge clusters propagation
    - realistic signal time development
- Both available in GlastRelease
- Correct link to TKR calibration DB
  - ToT shape correct in MC
  - slight improvement on hits/clusters discrepancy

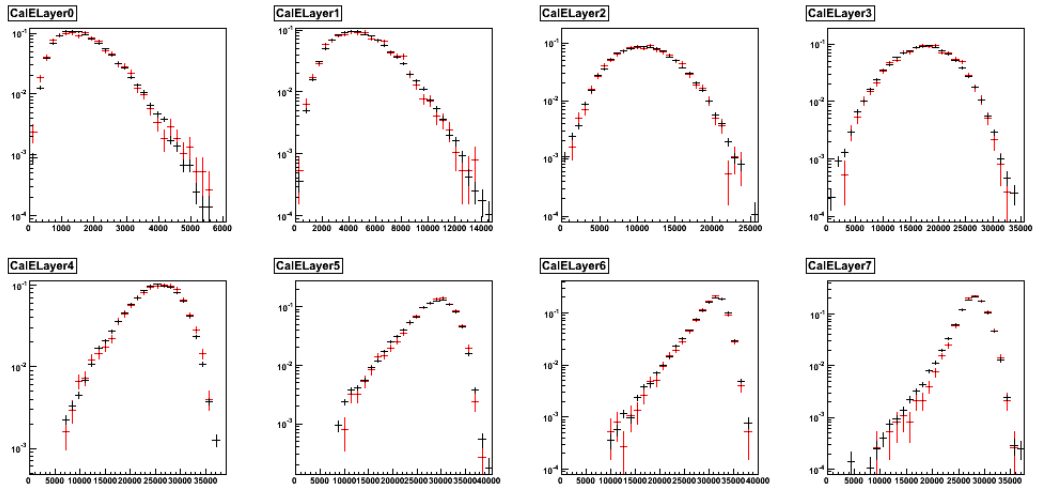




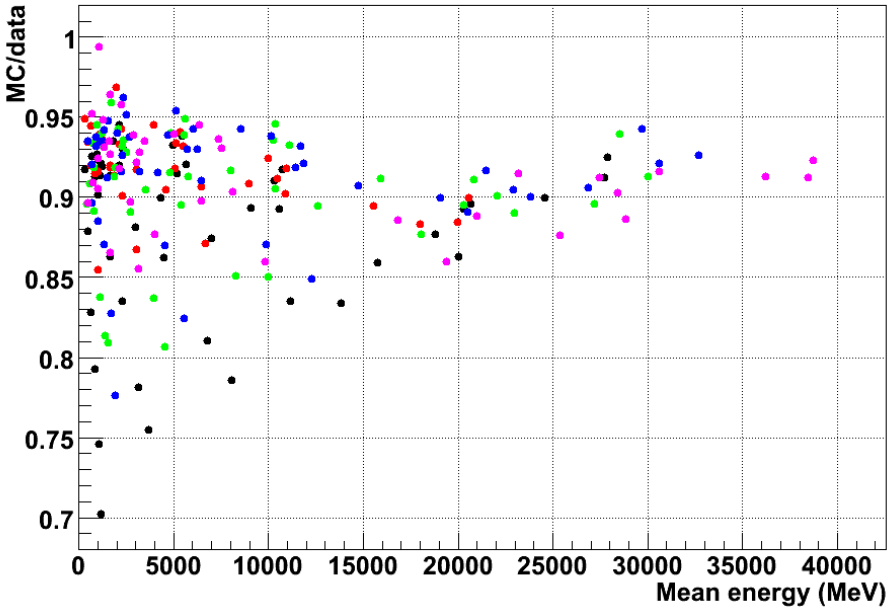
CAL Performance – energy measurement

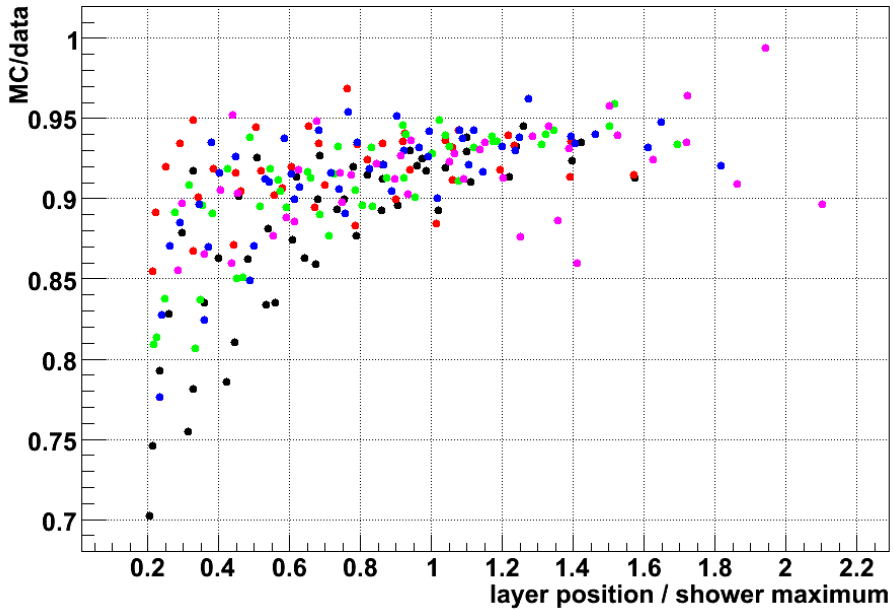
- **Raw deposited energy off by 5-20% wrt to MC predictions**
- **Specific correction factors correct this and hint to a calibration issue**
  - **Unfortunately a direct calibration from data is not possible since these factors depend upon incoming energy, angle, log position wrt to shower axis**
  - **CAL calibration extensively improved**
  - **Investigation on gap effects in progress**
- **Final performance for energy measurement expected as from MC simulation studies after energy scale factor is solved**





Cal energy measurement





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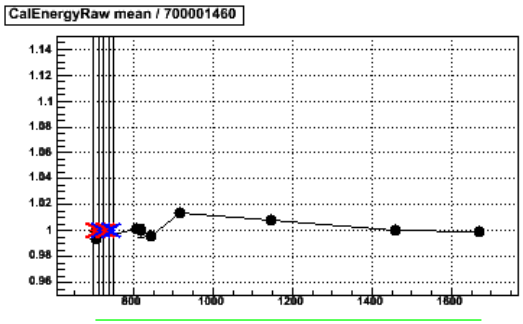
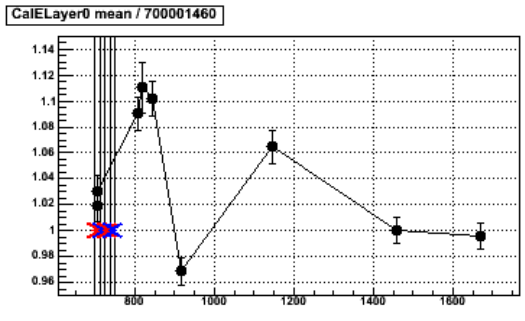
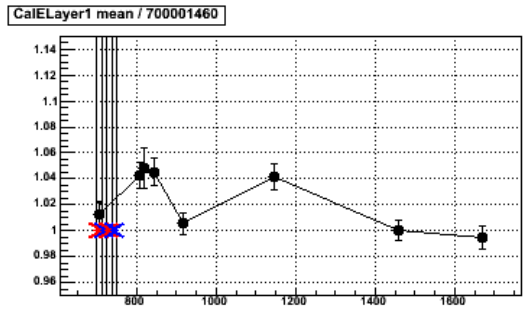
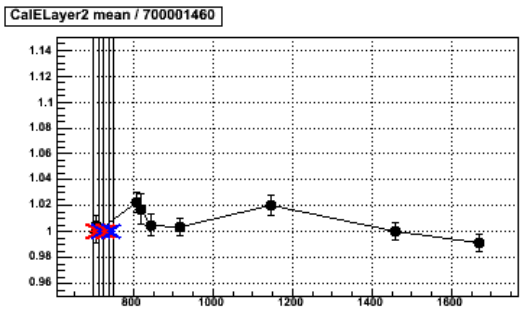
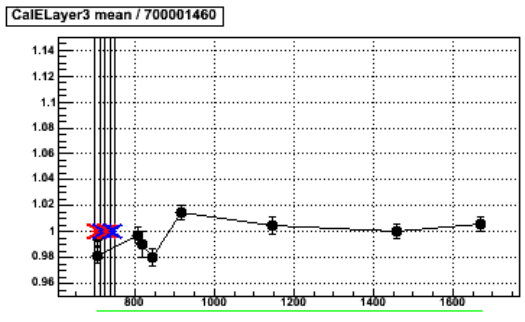
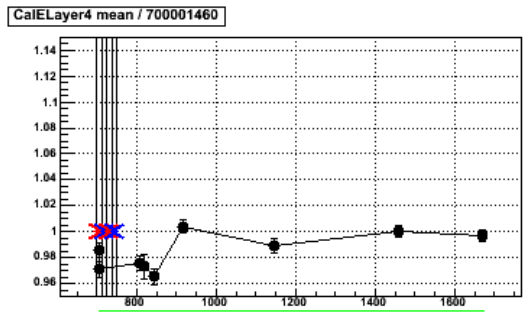


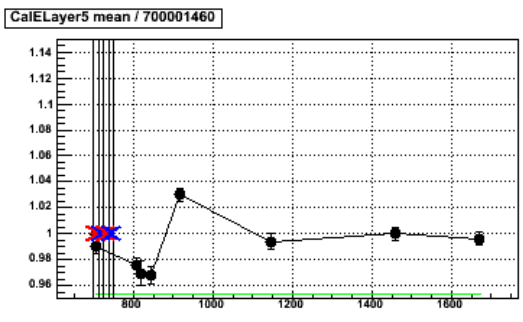


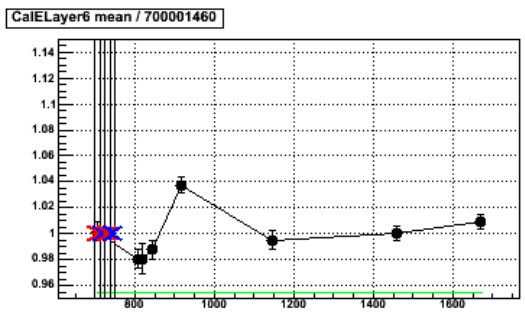


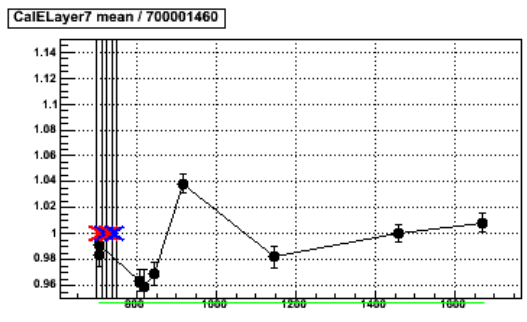




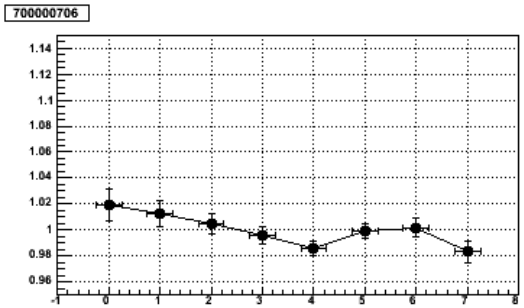


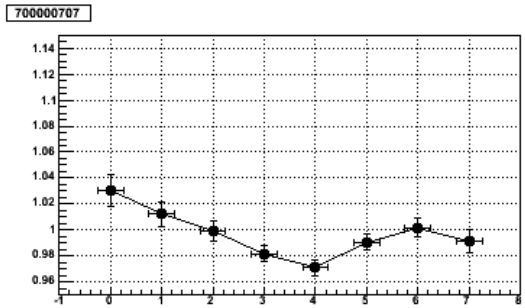


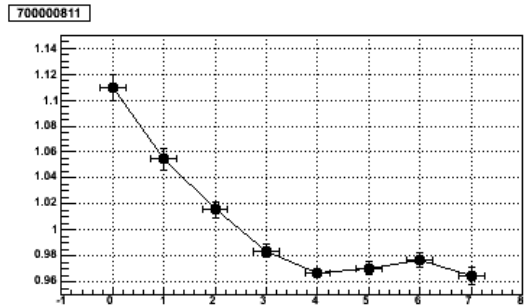


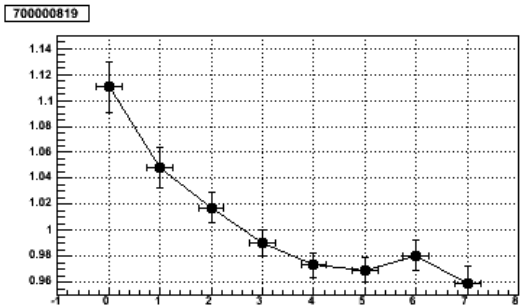


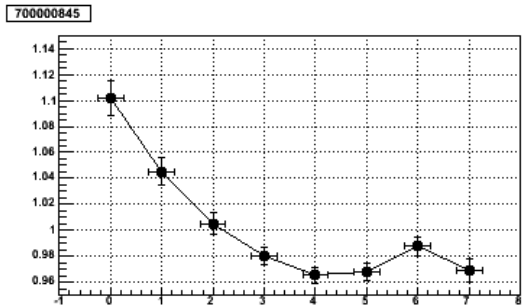
Cal energy measurement

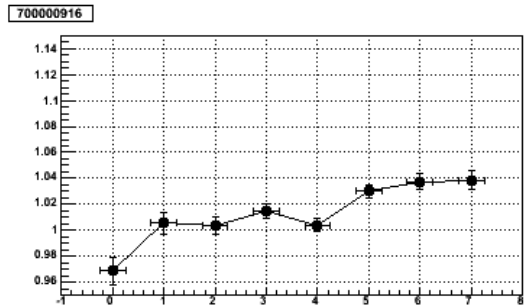


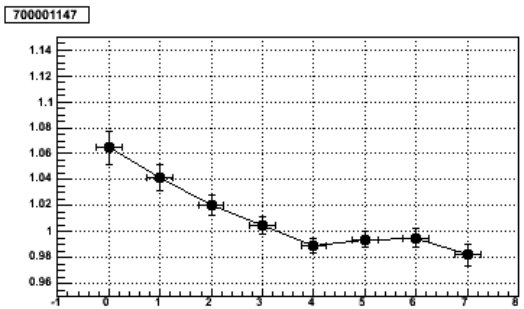


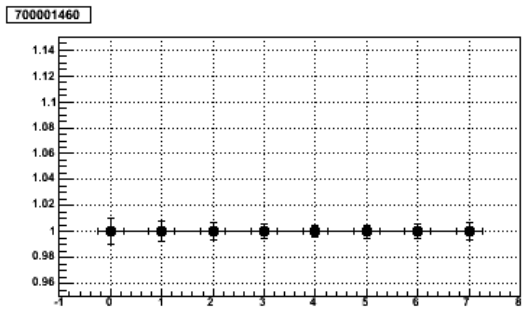


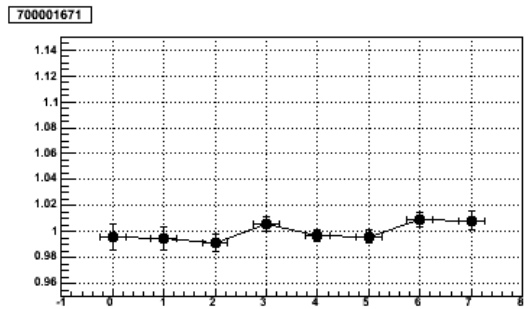






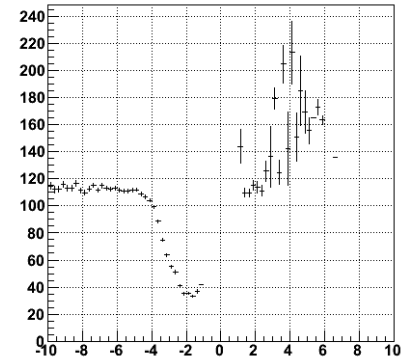




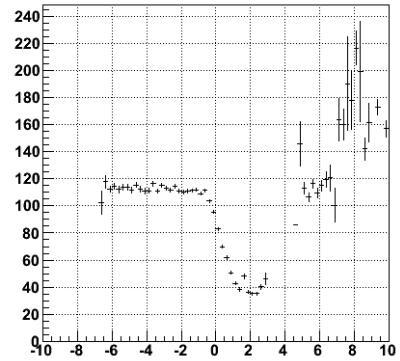


Cal energy measurement

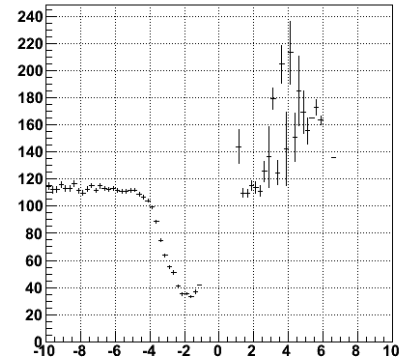
TkrTotalHits:Tkr1Y0



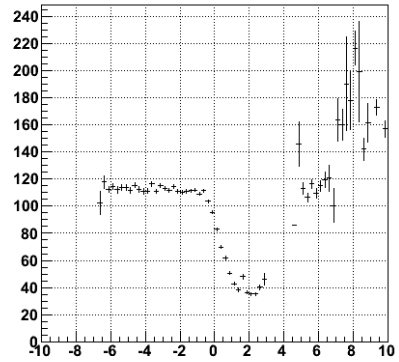
TkrTotalHits:extrapolated Tkr1Y0



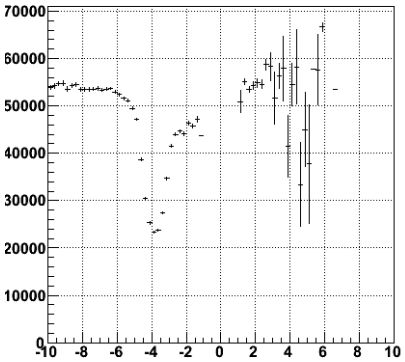
TkrTotalHits:Tkr1Y0



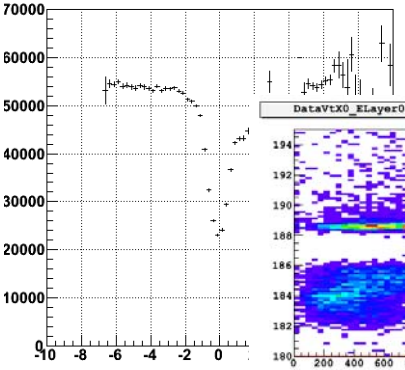
TkrTotalHits:extrapolated Tkr1Y0



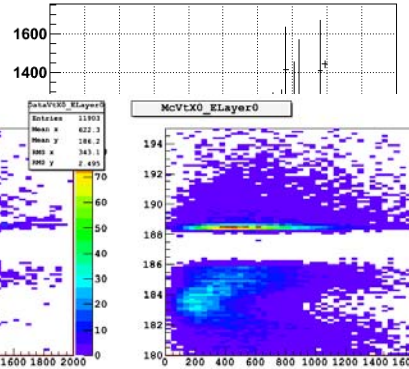
CalEnergyRaw:Tkr1Y0



CalEnergyRaw:extrapolated Tkr1Y0



CalELayer0:Tkr1Y0



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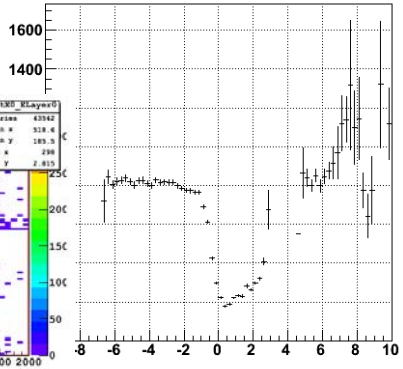
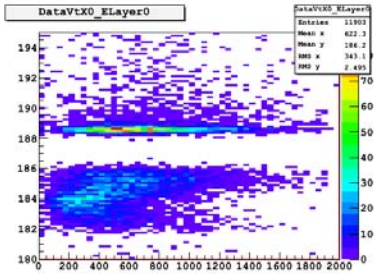
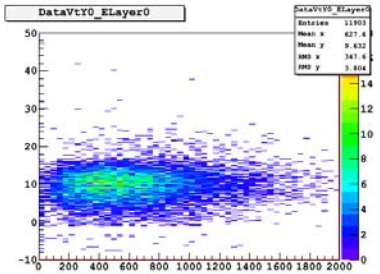


DataVtX0_ELayer0

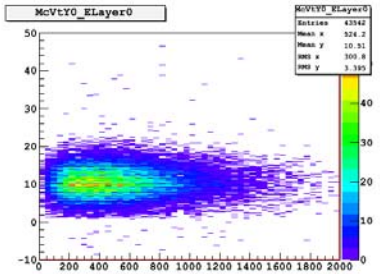


McVtX0_ELayer0

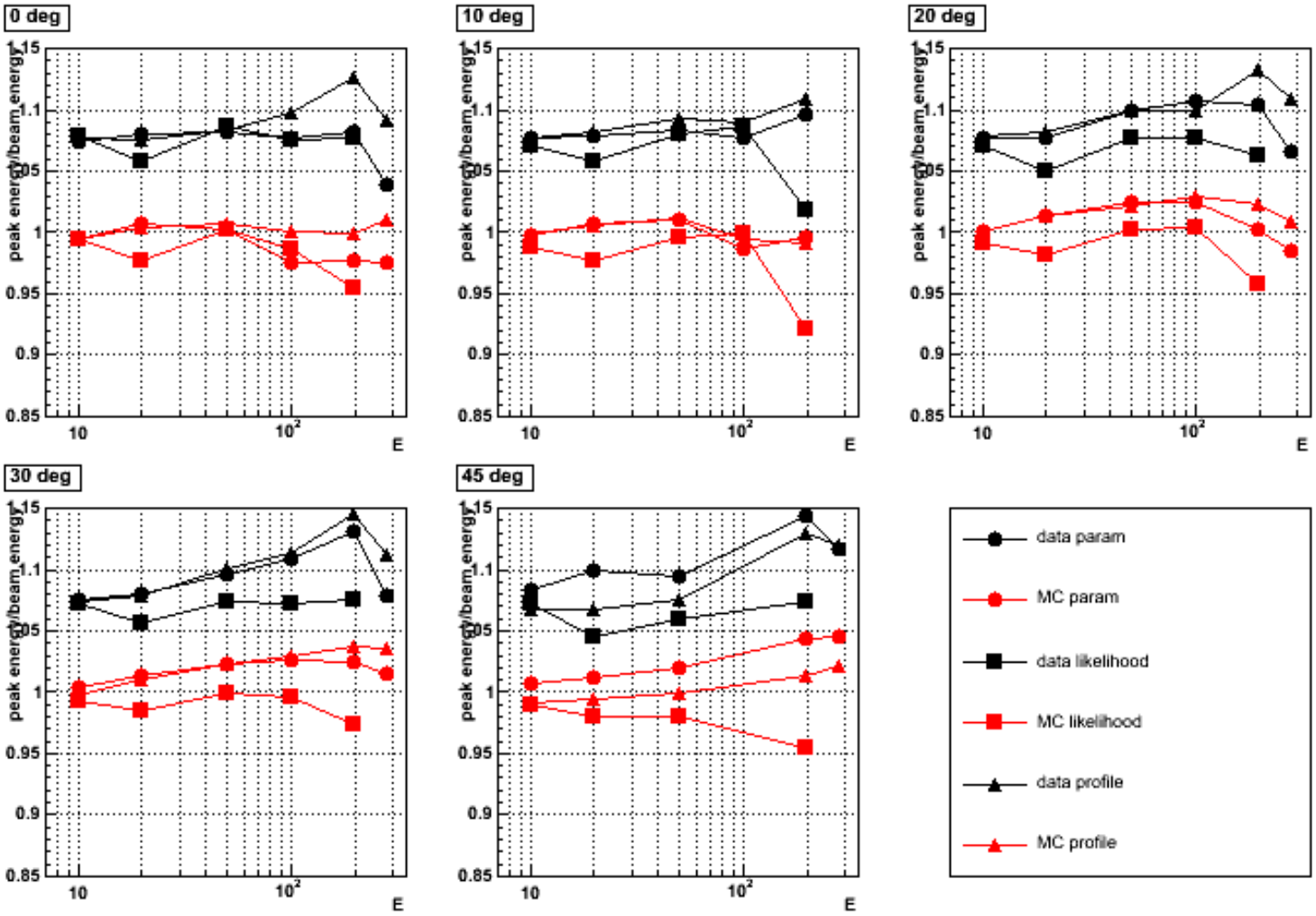
DataVtY0_ELayer0



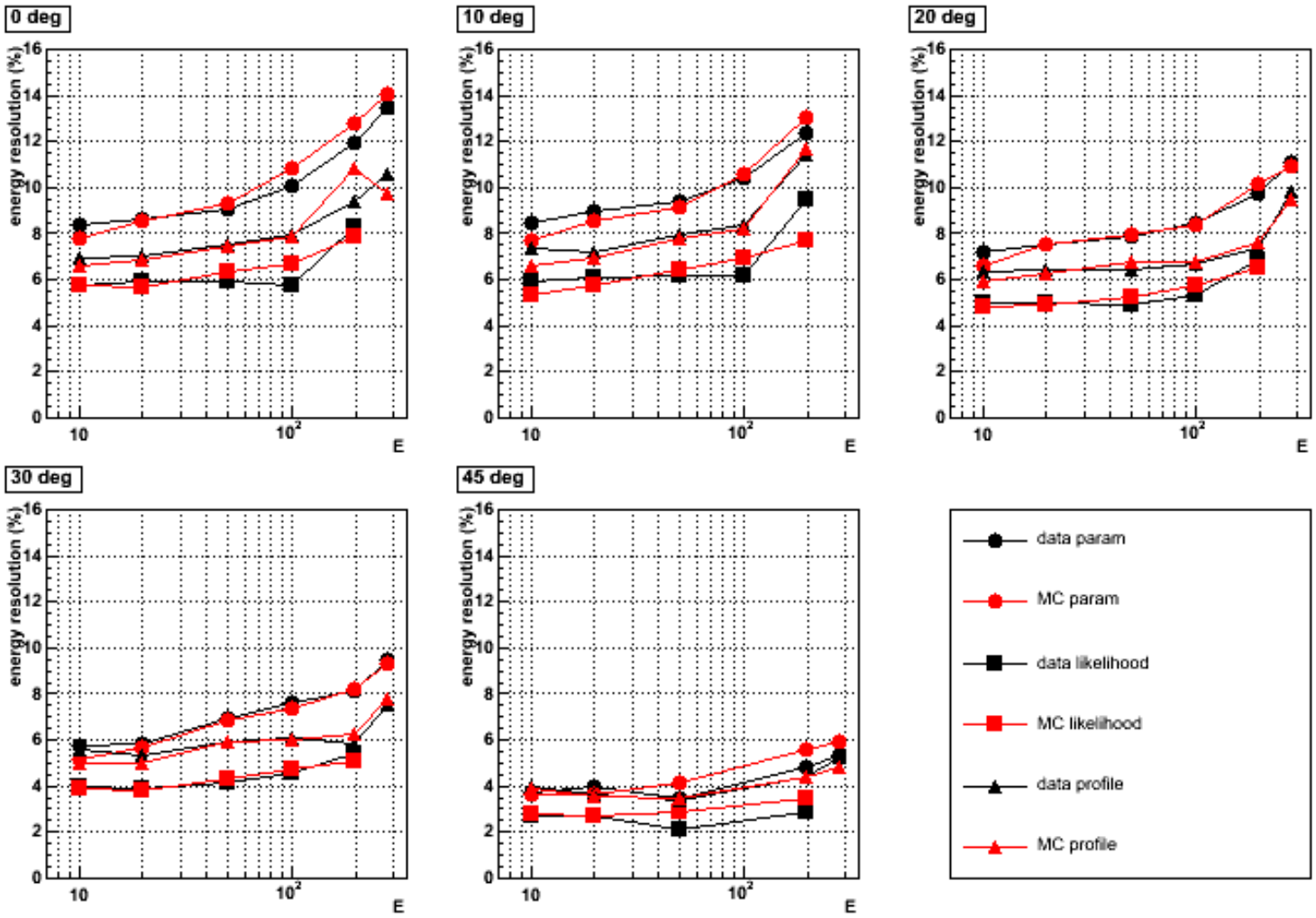
McVtY0_ELayer0



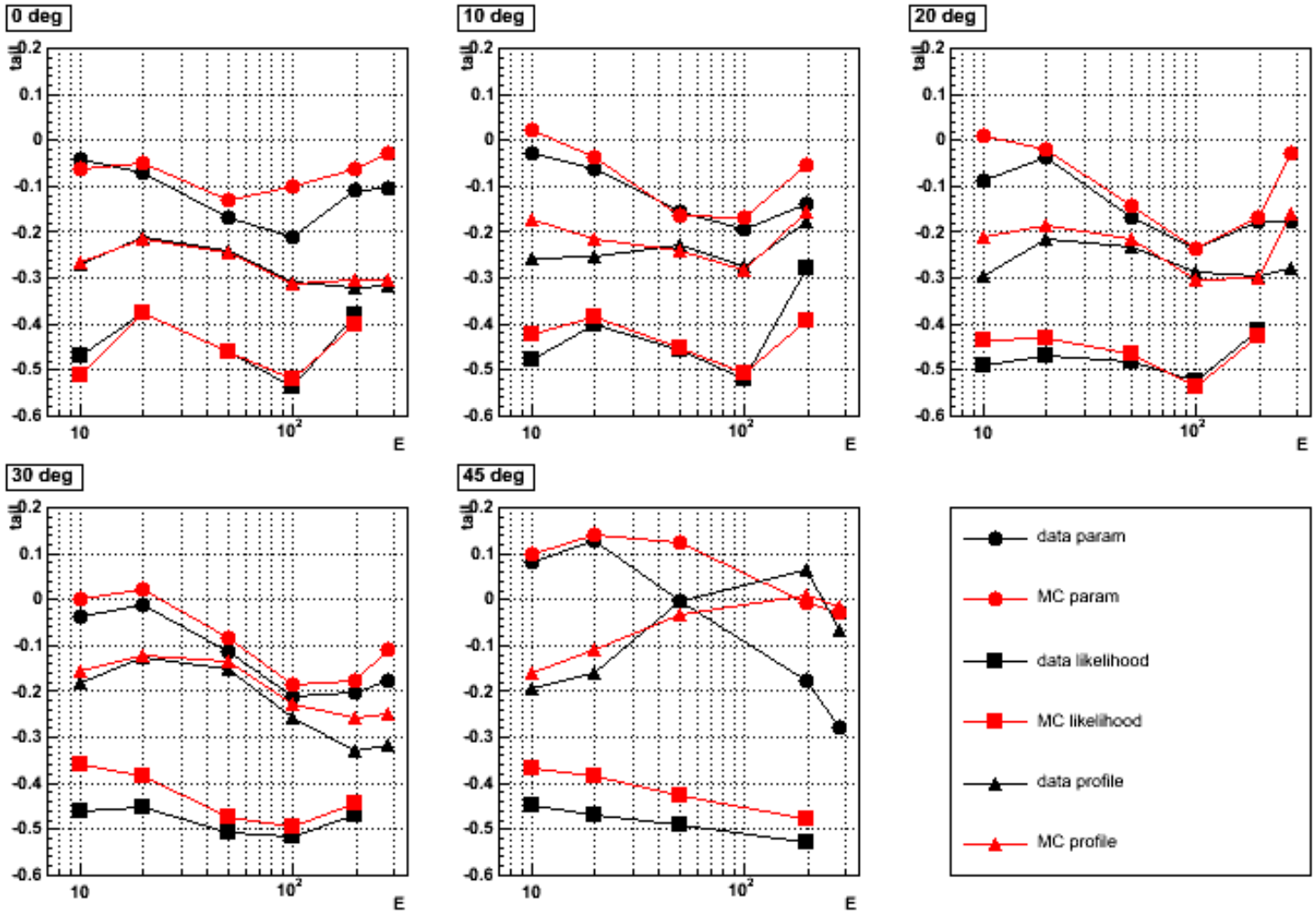
Energy measurement : bias



Energy measurement : resolution

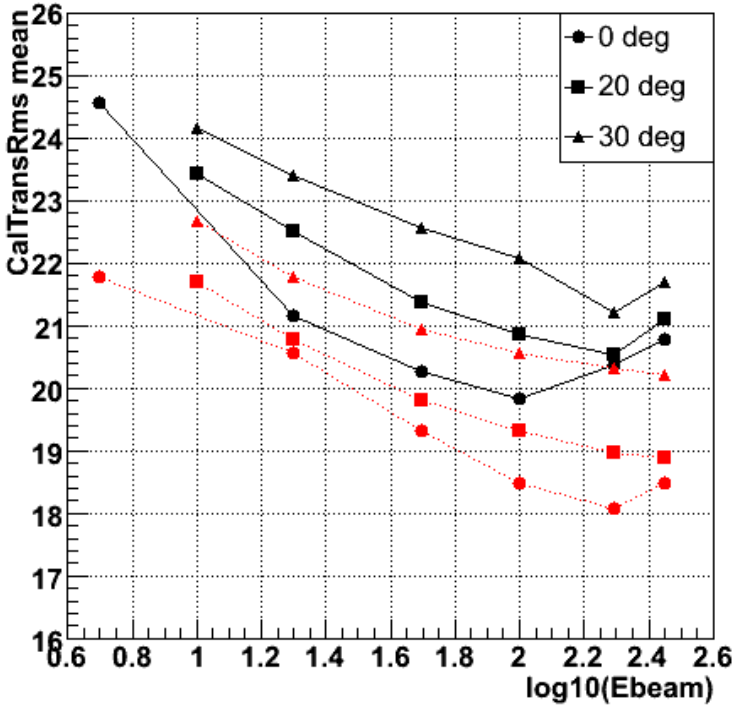


Energy measurement : tail

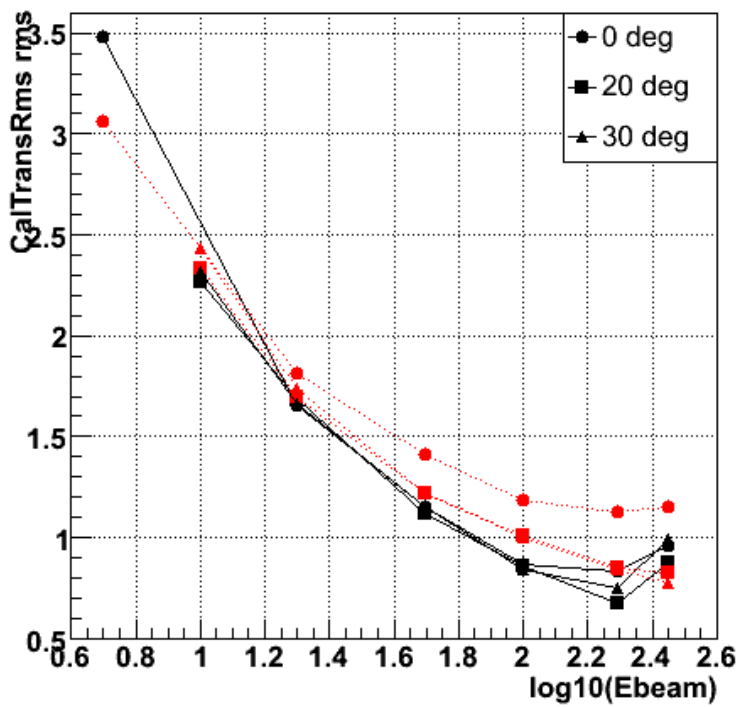


Shower transverse size

CalTransRms mean (data-black, MC-red)

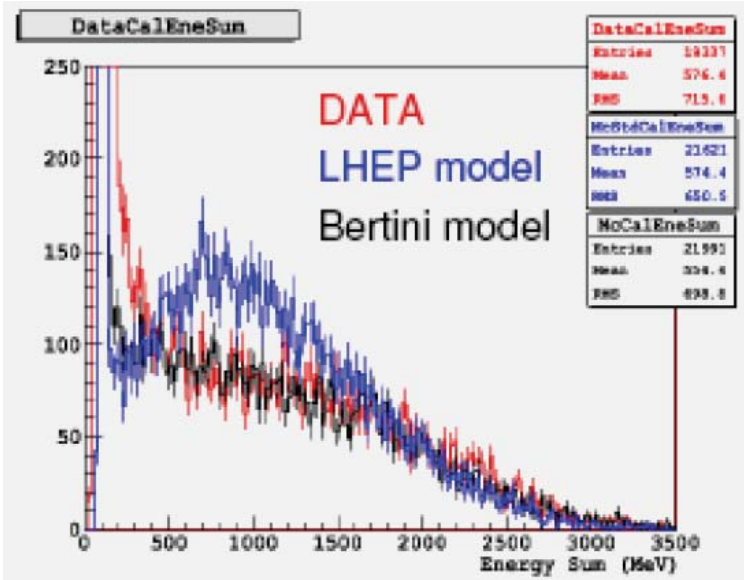


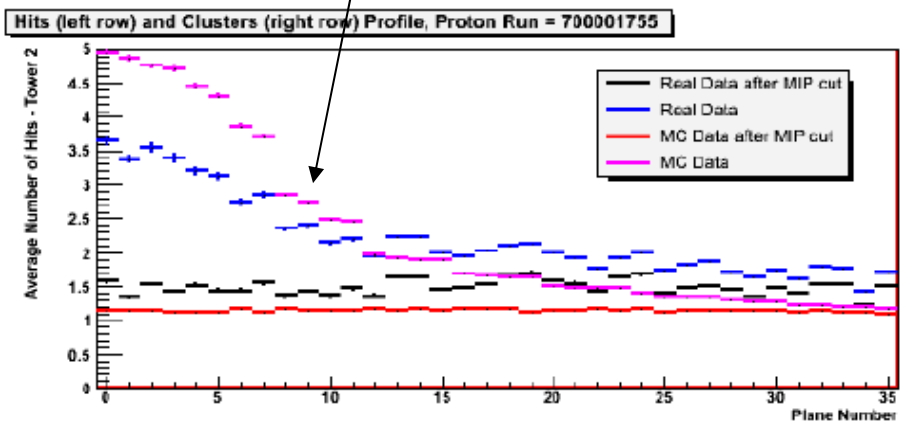
CalTransRms rms (data-black, MC-red)

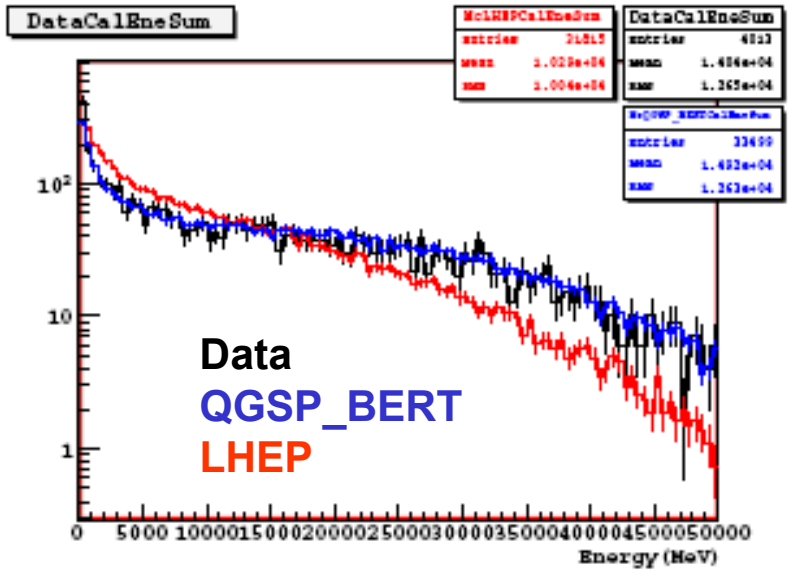


CAL Signal – Hadronic interactions

- crucial for bkgnd rejection
- Current best hadronic physics list
  - Bertini <10GeV
  - QGSP_BERT >20GeV
- Currently better agreement for hadronic physics wrt to EM
- But weird things to check in TKR hits

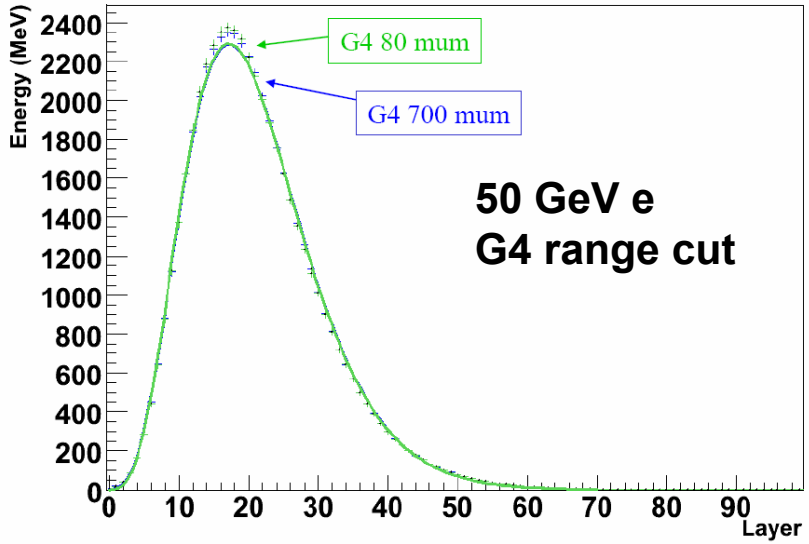


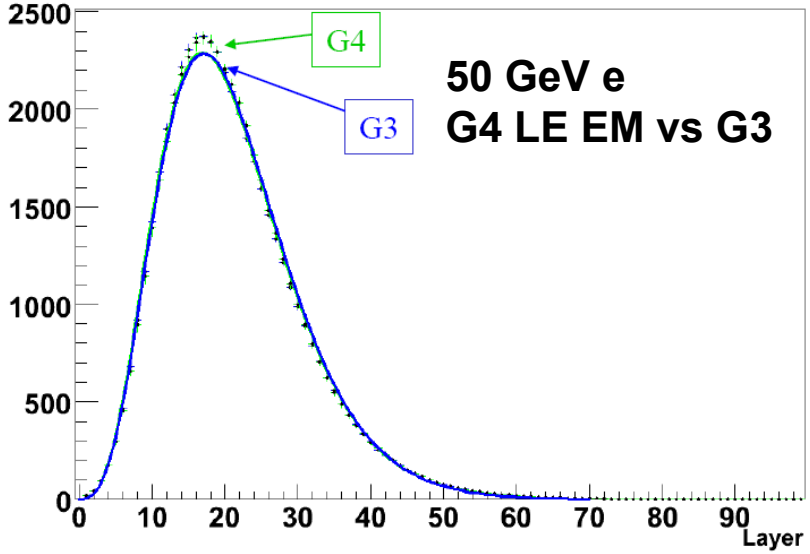


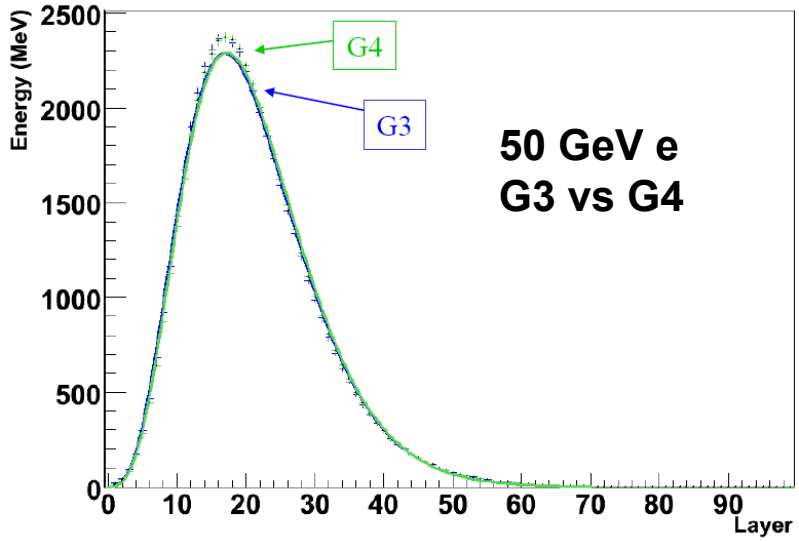


Geant4 consistency checks

- No effects from general Geant4 configuration parameters
  - Need deeper insight into single processes parameters
- Similar results obtained when checking effect of changes on TKR Hits

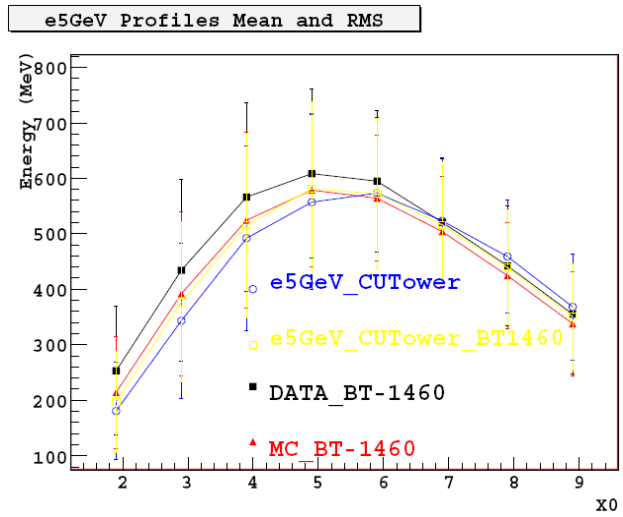


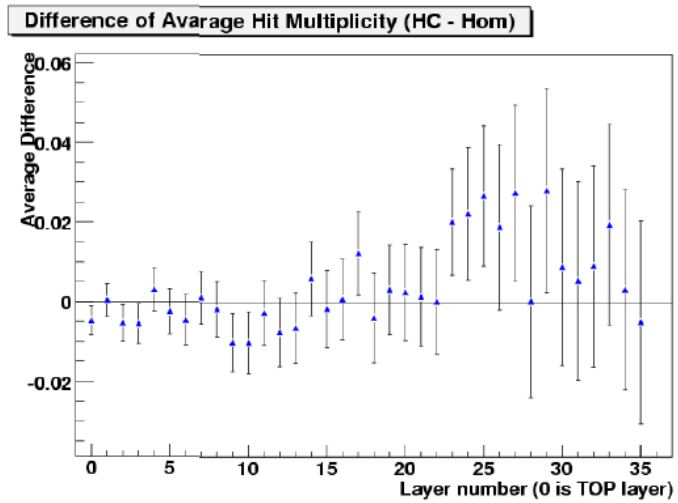




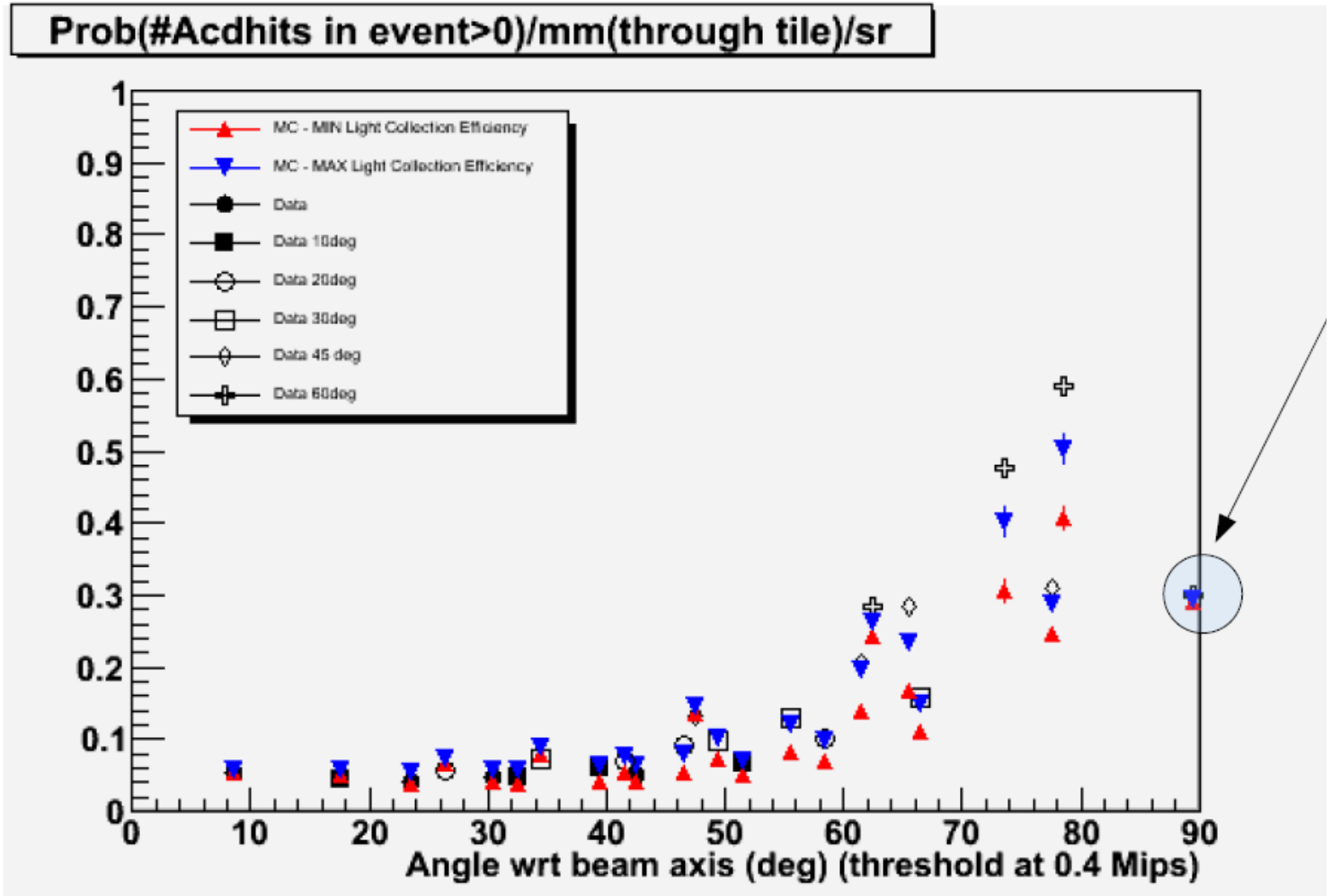
CU Tower G4-standalone simulation

- Decoupled detector geometry, particle propagation and generation MC code (G4), beam line simulation
- EM shower development
  - correct beam simulation (std-alone MC w/o beam simulation shifted in Tmax wrt std-alone MC complete)
  - std-alone MC complete and pipeline MC are the same
  - Data has more energy
- TKR Hits with realistic honeycomb vs averaged-density material
  - No effect on EM shower or TKR hits





ACD Backsplash angle probability



Beam Test Deliverables

Tkr digitization	✓ delivered to GR (TkrDigi v2r6 april07)	Charge sharing and ion signal	No significant changes to TKR hit counts
Cal calibration procedure	✓ column-wise charge injection in CAL CPT	Correct non-linearities in charge injection	Improved CAL calibration but did not solve energy shift Default calibration for the LAT Not relevant for simulation
CalRecon	✓ delivered to GR	Correct xtal and inter-range xtalk	Require mapping of xtalk for the LAT Not relevant for simulation
AcdDigi	✓ delivered to GR	better single ph-e signal simulation	
Hadronic physics list	Next SC production		1 background run with LE model (Bertini) already produced in current SC
Material review	Next SC production	Real TKR W thickness (-8%)	Must complete review of other subsystems

Plans forward

- Close to a new BTRelease
  - Synchronized with GlastRelease for an easier transfer of our results
  - Several recent bug fixed
  - Realistic beam spot in MC
  - TKR alignment in MC
- BT System test for quick and complete data/MC comparison
  - Well defined set of runs, cuts, plots for automatic comparison from all available analysis
  - Will run with new BTRelease
- Feed GlastRelease now with available deliverables
- Keep refining analysis to understand root cause of discrepancies
- Perform *ad hoc* simulations for Service Challenge
  - Devise a model to add existing discrepancies to current MC
  - Generate simulations and check effect on background rejection and IRF